

# Lecture Module - To Err is Human

ME3023 - Measurements in Mechanical Systems

Mechanical Engineering

Tennessee Technological University

## Topic 1 - Accuracy and Error

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- Thought Experiment
- Accuracy and Error
- Estimating Error
- Uncertainty Interval

# Thought Experiment

**Thought Experiment:** Look around the room and choose an object. It can be anything. Ask yourself the following questions.

- What is the **true** length of the object?
- How can you find the **true** value? Can you measure it?
- ...



Image: T.Hill

# Accuracy and Error

The exact value of a variable is called the **true value**. The value of the variables as indicated by a measurement system is called the **measured value**. The **accuracy** of a measurement refers to the closeness of agreement between the measured value and the true value. But the **true value** is rarely known *exactly*, and various influences, called **errors**, have an effect on both of these values. So the concept of the **accuracy** of a measurement is a *qualitative* one.

$$\text{error} = \text{measured value} - \text{true value}$$

Text: Theory and Design of Mech. Meas.

# Estimating Error

The **true value** can be estimated but cannot be known *exactly*. In practice a **reference** value is used in place of the true value. We will discuss this again in the *Calibration Module*.

$$\text{accuracy} = \frac{|\text{error}|}{\text{reference value}} \times 100$$

An estimate of error based using this value is sometimes referred to as **relative accuracy**.

# Uncertainty Interval

“The **uncertainty** is a numerical estimate of the possible range of the error in a measurement. In any measurement, the **error** is not known exactly since the true value is rarely known exactly. But based on available information, the operator might feel confident that the error is within certain bounds, a plus or minus range of the indicated reading. This is the assigned **uncertainty**.”

We will discuss this again the the *Uncertainty Module*.

Text: Theory and Design of Mech. Meas.